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Furnace Related Fires

By

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Fires started by furnaces have been a major factor in losses associated with residential and commercial property. The beginning of the heating season usually brings a rash of fire losses as marginal equipment that survived the previous season fails, causing a fire. During the heating season as cold spells occur, marginal equipment is often over stressed, resulting in a fire. After a thorough burn pattern analysis is performed on the building and a preliminary assessment indicates a furnace related fire, a closer look at the furnace installation may be fruitful. The following is a listing of some typical fire causation modes associated with furnace (and boiler) fire losses that may be helpful in a causation analysis:

Combustible Material near the Furnace

Some furnace rooms act as a depository for cardboard boxes, garbage and other combustible materials. Placing these items close to a furnace can cause a fire as a result of heat transfer from the furnace or flame rollout from the draft diverter. Check for the remains of unusual combustible material near the furnace. Inquire as to what was in the furnace room at the time of the fire.

Improper Furnace Installation

Furnaces and furnace flues are often required to be installed with certain clearances from combustible building materials. Figure 1 shows the remains of a single wall flue vent installed near a floor joist causing the fire. The flue vent should have been a double wall design that reduces heat transfer from the hot flue gases to the floor framing.

Control Malfunction

Several controls are installed in a furnace to reduce the chance of a fire. Such controls are the high temperature limit switch, thermocouple pilot flame failure sensor and flue spillage sensor. Failure of any of these could result in a fire.

Figure 1

Figure 2

Figure 2 shows a typical furnace burner with the gas control valve indicated by the arrow. The gas control valve houses several safety features that should be checked during examination.

Figure 3 shows a typical high temperature limit switch that is designed to turn off the furnace when plenum overheating occurs. If

a control malfunction is suspected, laboratory testing should be performed on the suspected control mechanism if possible. Handle the controls with care. Jarring a sticky gas valve could result in loss of evidence.

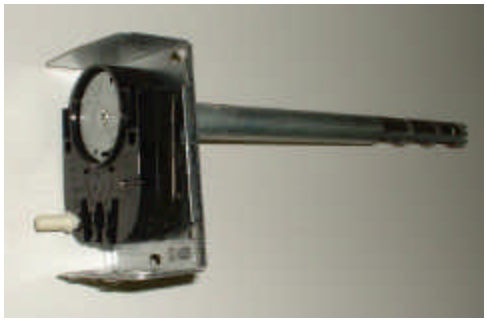

Figure 3

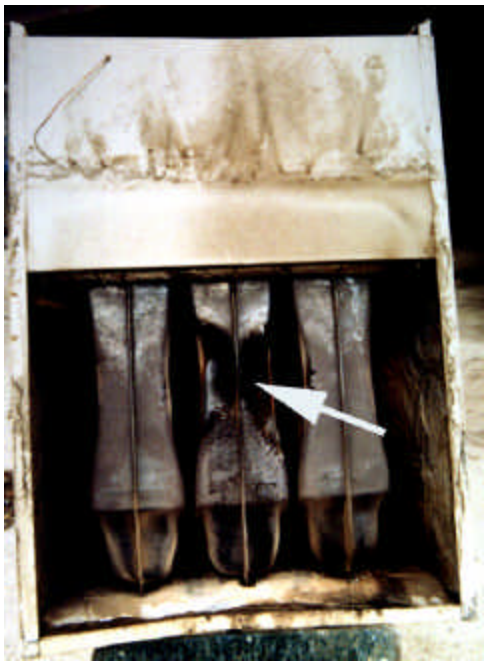

Figure 4

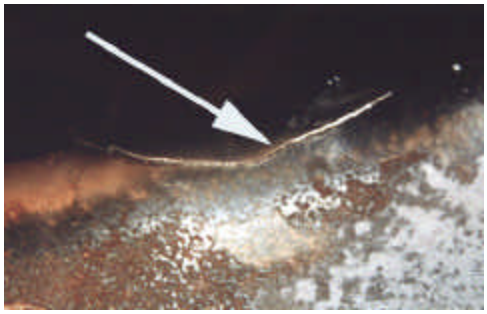

Figure 5

Cracked Heat Exchanger

Figure 4 shows a cracked heat exchanger brought on by cyclic thermal stresses. Figure 5 is a close-up of the crack. As the crack develops, hot combustion products can impinge on combustible materials causing a fire. Heat exchanger cracks can also cause indoor air pollution with sometimes serious health effects.

Improper Wiring

Although rare, improper wiring of furnace control systems can cause a fire. One recent loss was a result of an improperly connected wire that bypassed overheating safety devices. When the fan motor failed, the furnace overheated since the high temperature safety devices were ineffective, resulting in severe damage to the building.

Figure 6

Sludge

Accumulation of debris or sludge in boilers can cause over- heating and fire. Figure 6 is a section of a boiler heat transfer tube that is partially blocked with calcium deposits as indicated by the arrow. Note the burned heat transfer fins. This is usually a result of poor maintenance on the boiler system.

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